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REPRESENTING ATTITUDES: SOME PRIMITIVE STATES.(U)
JAN 78 R C SCHANK, R WILENSKY, J G CARBONELL N00014-75-C-1111

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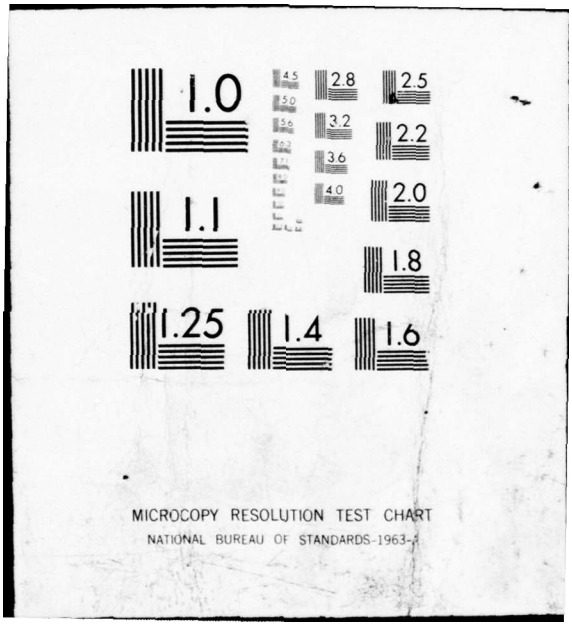
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A natural language utterance may denote an attitude - a disposition of a person toward another person, object, activity, or state. In order to represent the meaning of such utterances, we propose a small set of primitive attitudinal states. Sentences which denote attitudes can then be represented in terms of these attitudinal primitives. The utility of this representation is demonstrated by its ability to organize inferences needed for natural language understanding.

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REPRESENTING ATTITUDES: SOME PRIMITIVE STATES

by

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REPRESENTING ATTITUDES: SOME PRIMITIVE STATES

1.0 INTRODUCTION

Words involving human affects are hard to analyze. For example, consider the usage of the verb <u>like</u> in these sentences, followed by a description of the most usual meaning:

1. I like cars.

   This sentence can be interpreted to mean that I have a fondness toward automobiles, or that I enjoy driving.

2. I like foreign cars.

   I think they're better than the domestic variety.

3. I like blonds.

   I am physically attracted toward people with blond hair.

4. I like physics.

   I might enjoy taking a physics course, or enjoy doing physics.

5. I like therapy.

   I find my therapy sessions beneficial.

6. I like winter.

   I enjoy winter weather, or winter activities.

7. I like Mary.

   I'm fond of Mary.

8. I like Picasso.

   I enjoy looking at Picasso's artwork.

9. I like my dentist.

   I find my dentist to be competent.

10. I like ice cream.

    I find the taste of ice cream pleasurable.

11. I like football.

    I enjoy watching or playing football.

12. I like Sun King (the name of a horse in a race).

    I think Sun King will win the race.

13. I like the Moody Blues.

    I enjoy listening to the Moody Blue's music.

There are an enormous number of different senses of <u>like</u> found in the above examples. It is important to distinguish among these different senses because different inferences can be made from each sense. These inferences

can be crucial in understanding a person's actions. For example, if "John likes Mary", we may infer that he knows Mary and enjoys spending time with her. Then if John saw Mary walking down the street, we would find it odd if he failed to say hello and otherwise relate to her. On the other hand, if "John likes Carter", we would not infer that John knew Carter, but we might infer that he respected him. Then if John saw Carter walking down the street, we would understand it if John just stared at him.

Before we can determine how a natural language processor could distinguish among these senses of <u>like</u> to find the correct interpretation of each sentence, we must first know how to represent the meanings that each of these word senses denotes. In each case, the meaning of these sentences is some kind of human mental state. Many of these states, however, are of quite a different character than those we have studied in previous Conceptual Dependency analyses (Schank, 1975). Unlike emotive states or states of belief or knowledge, which describe how a person feels or what he knows at a given time, these states describe a person's <u>attitudes</u>. When we say "John likes Mary", we say nothing about his feelings at any particular moment. It is possible, for example, to be very mad at someone whom you like. What we have labelled attitudes here, then, are not one-shot predictors of behavior. Rather, they are more long term. They are not felt, that is, they are not emotions. They may have arisen from a conscious decision, or feeling

derived from a long term set of events.

We define an attitude as a perception one person has of something that can be used to predict that person's behavior. An intelligent language processer needs knowledge about how attitudes affect behavior if it is to make the inferences necessary to connect together the sentences of a story. For example, consider the following short story:

(1) John loved Mary. One day, John saw a truck coming down the street toward Mary. John ran up behind Mary and gave her a shove.

(2) John hated Mary. One day, John saw a truck coming down the street toward Mary. John ran up behind Mary and gave her a shove.

Suppose after each story we were now asked why John pushed Mary. In story (1), the most reasonable answer seems to be that he was trying to push her out of the way of the truck. We can make this inference because we have the knowledge that if a person loves someone, then he will help that person if that person becomes endangered. On the other hand, in story (2), we might assume that John was trying to push Mary in front of the truck. The source of this inference is the knowledge that we may take an opportunity to harm someone we dislike greatly.

Thus attitudes constitute an important class of <u>themes</u> - states that can give rise to goals (Schank and Abelson, 1977). Depending upon the attitudes possessed by the characters of a story, an understander may come up with strikingly different interpretations of a story, and respond

quite differently in post-understanding tasks such as question answering and summarization. To build such an understander, therefore, we need to address the questions of what kinds of attitudes there are and what kind of knowledge is organized around them.

This paper is concerned with representing attitudinal states such as those suggested by the _like_ examples above, and with eliciting the inference rules that can be organized around these states. To provide satisfactory representations of attitudes, we found it necessary to invent a set of _attitudinal primitives_. Each attitudinal primitive is a kind of scale, similar to other state scales in Conceptual Dependency. An attitude of a person toward something can then be represented as a point on a particular attitudinal scale.

We found that the set of attitudinal primitives and the inferences that could be drawn from them were largely a function of the kind of object toward which the attitude was directed. The following classes of attitudes turned out to be distinguishable:

1. Attitudes toward people describe ways in which people can view each other. "John likes Mary" falls into this class.

2. Attitudes toward physical objects describe how people feel about things. "John likes his luger" might refer to John's peculiar fondness for his gun, for example.

3. Attitudes toward activities explain how people feel about doing things. An example is "John likes sailing."

4. Attitudes may also be directed toward experiencing a sensation. For example, "John likes garlic" most probably refers to a sense impression.

5. Attitudes toward states are also possible. "John likes owning tin foil" is an example of this class.

A relatively small number of attitudinal primitives can be used to represent the vast bulk of sentences expressing attitudinal states. We believe that these attitudinal primitives are adequate for organizing the knowledge people have about attitudes.

1.1 Some Caveats

1.1.1 Related Issues -

There are many important issues that this exposition raises but does not address. First, not all the senses of <u>like</u> given above involve attitudes. "I like my dentist" (in

the sense that I feel that he is qualified), and "I like Sun King" (in the sense that I feel he will win the race), are not affective states but the results of cognitive decisions. In a forthcoming paper we will discuss the representation of these cognitive states, and the mental processes which give rise to them.

Second, many of the attitudinal states discussed below are closely related to emotive states. Emotions are distinct from attitudes in that they always refer to specific experiences, while attitudes always refer to generic ones. For example, "John likes Mary's singing" is an attitude held by John, but "John liked Mary's singing" refers to an emotive state felt by John.

Although several attitudes have corresponding emotive states, we have not found a general a one-to-one correspondence between attitudes and emotions. The emotions we found useful in our exposition of attitudes are taken from Schank (1975). We have no reason to believe that these constitute an exhaustive list of emotional primitives underlying linguistic expression (Although others working independently have come up with similar sets. See Tomkins (1972), for example). Much more work needs to be done in this area, and we will not attempt to address the problem of representing emotive states in this paper.

1.1.2 Psychology -

While the notion of attitude does not appear to have been given much treatment in Artificial Intelligence research, there is a huge body of pertinent social psychology literature (see Heider (1958) and Fishbein and Martin (1975), to scratch the surface). Unfortunately, most of this literature does not have a direct bearing on the task at hand for a number of reasons. There is an important difference in orientation between our goals and those most often pursued in social psychology. Most of the social psychology literature deals with the question of what attitudes <u>really</u> are: How should the notion of attitude be functionalized for experimental purposes, how do attitudes influence behavior and decision making, and most importantly, how do attitudes change?

Our own goals are to elucidate those attitudes that people use to understand language and make inferences; i. e., we are interested in the attitudes people <u>think</u> they have, whether or not this "folk" psychology can stand up to experimental scrutiny (There is in fact evidence that it does not. See Abelson (1972), for example, for a critique of the use of attitudes to predict behavior). Thus we are not so much concerned with the objective utility of the attitude scales we propose in predicting a person's behavior in a situation, but in the ability of our attitudes to predict the inferences people will make in understanding a

natural language text.

There is another drawback to using the results of social psychology research. Some of the more analytic social psychologists have attempted to establish dimensions for attitudes or personal perceptions based on multi-dimensional scaling techniques and the like (for example, Osgood (1966) and Triandis (1972)). That research is geared to finding a minimum number of scales that will account for the maximum amount of variance observed in experimental data. However, this approach ignores the possiblity that the scales it will find significant may not be adequate for the organization of inference; even a small amount of unaccounted for variance may reflect a sizable number of unsolved inference problems.

Since the justification for our own research is its ability to organize the inferences needed for natural language processing, a set of dimensions based on their ability to account for variance is not directly of use to us. However, we remain hopeful that empirical studies based on attitudinal primitives like the ones we propose below could shed light on their interdependence and on the veracity of the inference rules we have adopted.

1.1.3 Criteria For Representation -

As we have mentioned previously, the most important criterion by which we wish our representations to be judged is their ability to organize inferences. In addition, there is one other factor that we feel is important for any representation of meaning underlying language utterances: the representation should not be a function of the particular surface linguistic formed used; rather, it should be exclusively a function of the meaning of the text. This is the criterion of canonical form described in Schank (1975). The intuition behind this criterion is that people will remember the same meaning of sentences that are paraphrases of one another. Therefore sentences that mean the same thing should have the same representation even if their linguistic forms are different. For example, the following sets of sentences should have exactly the same meaning representation:

Mary likes to look at Picasso paintings.
Mary enjoys looking at paintings by Picasso.
Mary likes Picasso.
Mary finds Picasso paintings very pleasing to look at.

Mary hates the taste of garlic.
Mary hates to eat garlic.
Mary hates garlic.
Mary can't stand the taste of garlic.
Mary really dislikes garlic in her food.

This criterion also implies that very similar sentences may have significantly different representations. For example, "John likes Mary" should be represented quite differently from "John likes Picassso".

The criterion of canonical form places a great deal of stress on the capabilities of a natural language analyzer to correctly determine the meaning of an utterance. For example, to find the proper representation of "John likes Picasso", a natural language understander must know that Picasso was an artist, and have a rule like the following:

> If the object of the verb like is a person who is responsible for producing an product whose function is to be attended to by one of the senses, then the attitude is one of enjoyment of the sensation of attending that sense to the products that person produces.

In addition, finding the correct interpretation of a sentence often requires access to contextual information. For example, if John was known to be a close friend of Picasso's, then "John likes Picasso" might be interpreted similarly to "John likes Mary". Without a context, in fact, virtually all of the like examples given in the beginning of this paper are thoroughly ambiguous.

We will not attempt to give an exhaustive list of rules for the understanding and disambiguation of words involving attitudes. We merely wish to point out the complexity of the problem, and note that any such set of rules must be based on the meaning representations into which sentences are to be mapped. Once these representations have been delineated, then it becomes plausible to develop such a set of rules for contextual language understanding mechanism (like that described by Riesbeck (1974)) to actually perform the language analysis.

One particularly confusing representational issue relates attitudes to their causes. For example, if John likes Mary, he may well like her because she is blond, or has a nice personality. However, we represent the reasons why John likes Mary separately from the fact that he likes her. This is because the reasons behind an attitude are often unknown, irrational, or non-existent; they may have caused the attitude to come into being, but can be considered independently from it.

On the other hand, when we say "John likes Picasso", then the fact that John likes looking at Picasso's artwork is the meaning of this sentence, not the reason behind an independent attitude of John liking Picasso. The point here is that it is important to distinguish determining the reason behind an attitude from the determining the object of the attitude. The former is a process that may be carried out after the sentence is understood and the attitude represented; the latter is an integral part of determining the meaning of the utterance.

I.2 The Form Of The Representation

To represent the attitudes described below, we introduce a new dependency arrow "<a>", denoting an attitudinal state. All of the attitudinal states presented here use the following representational format:

POSSESSOR <a> ATTITUDE(N) <--o-- OBJECT

where

1. POSSESSOR - The person who has the attitude.

2. OBJECT - The person, object or activity to which the attitude is directed.

3. ATTITUDE - The name of the primitive attitude.

4. N - The intensity of the attitude (by convention, the intensity usually ranges from +10 (a strong positive attitude) through 0 (denoting ambivalence) to -10 (a strong negative attitude).

2.0 ATTITUDES TOWARD PEOPLE

We divide the ways in which people perceive one another into three classes of attitudes: emotive, evaluative, and obligational. An emotive attitude is based on an emotion previously felt toward a person and likely to be felt again. Evaluative attitudes contain intellectual judgments of a person's character or worth. Obligational attitudes constitute the recognition of some social obligation toward or from an individual.

2.1 Emotive Attitudes

Emotive attitudes are distinct from emotions in that an attitude can be true when no emotion is being experienced. For example, we can say that the attitudinal sense of "John loves Mary" is true even though at the time we allege this, John may be not be thinking of Mary at all, or may even feel some negative emotion toward her, such as anger. On the other hand, the emotive sense of "John loves Mary," i. e., John is now feeling love for Mary, describes John's present mental state. Rather than describing emotional feelings, attitudes are useful for predicting emotional reactions, as well as other forms of behavior.

2.1.1 FONDNESS-ANTIPATHY -

The FONDNESS-ANTIPATHY dimension is meant to capture the basic positive or negative attitude people can have toward one another. Words like love, like, and hate give rise to representations involving this dimensions. For example, the following English sentences have representations involving the FONDNESS-ANTIPATHY dimension:

(3) John loves Mary.

JOHN <a> FONDNESS(+8) <--o-- MARY

(4) John is madly in love with Mary.

JOHN <a> FONDNESS(+10) <--o-- MARY

(5) John likes Mary.

JOHN <a> FONDNESS(+3) <--o-- MARY

(6) John hates Mary.

JOHN <a> FONDNESS(-8) <--o-- MARY

(7) John didn't care much for Mary.

JOHN <a> FONDNESS(-3) <--o-- MARY

Attitudes may be directed toward a group of people as well as an individual:

(8) John likes the Irish.

JOHN <a> FONDNESS(+3) <--o-- Irish people

Changes of attitude are represented similarly to other state changes:

(9) John is falling in love with Mary.

```
          |---> FONDNESS(+8)
JOHN < a  |                    <--o-- MARY
          |---< FONDNESS(x)
```

2.1.1.1 Rules -

The FONDNESS-ANTIPATHY dimension has the following inference rules associated with it:

1. If A has FONDNESS-ANTIPATHY of degree n toward B, then A will have the goal of being near to B (of avoiding B if n is negative), with the strength of

the goal being a function of n.

2. If A has goal G, then the greater n is, the more B will want A to achieve goal G. If n is negative, greater the absolute value of n, the more B will want A not to achieve goal G. For example, if n is 8, and B wants an ice cream cone, A might get it for B. If B is endangered, A might act to rescue B. If n is -8, and B wanted to buy a particular house, A might buy it first just so B couldn't get it.

3. The greater n is, the more A will have the goal of developing positive relationships with B (i.e., friendship, lovers, etc.)

4. When A is with B, A will feel JOY in accordance with n. E. g., if n is high positive, then A will feel great joy when with B, if n is low negative, then A will be unhappy to be with B.

5. If an opportunity presents itself to A to help (hurt) B, A will act to benefit(harm) B in accordance with n.

2.1.2 FASCINATION-DISINTEREST -

Just as FONDNESS-ANTIPATHY is distinct from an emotion felt at a given point in time, so is FASCINATION-DISINTEREST separate from the feeling of interest that might be experienced, as in "John was fascinated by the dazzling colors." FASCINATION-DISINTEREST is used to represent sentences like:

(10) John thinks Mary is interesting.

JOHN <a> FASCINATION(+5) <--o-- MARY

(11) John thinks Idi Amin is fascinating.

JOHN <a> FASCINATION(+8) <--o-- AMIN

(12) John is enthralled by Mary.

JOHN <a> FASCINATION(+10) <--o-- MARY

(13) John thinks Fred is a boring person.

JOHN <a> FASCINATION(-5) <--o-- FRED

2.1.2.1 Rules -

If A has FASCINATION of degree n toward B then the following rules hold:

1. A will enjoy being with B in accordance with n.

2. A will enjoy listening to B in accordance with n.

3. A will find B entertaining in accordance with n.

4. A will seek out (avoid) B in accordance with n.

5. A will enjoy listening to stories about B in accordance with n.

2.1.3 FEAR-SECURITY -

As with the previous attitudes, a FEAR-SECURITY attitude can be held by someone independently of the emotion currently being experienced. We have the following sentences:

(14) John is afraid of Bill.

JOHN <a> FEAR(+5) <--o-- BILL

(15) John is afraid of strangers.

JOHN <a> FEAR(+5) <--o-- STRANGERS

(16) John has xenophobia.

JOHN <a> FEAR(+10) <--o-- STRANGERS

(17) John feels very relaxed with Mary.

JOHN <a> FEAR(-5) <--o-- MARY

2.1.3.1 Rules -

If A has FEAR of degree n toward B then the following rules hold:

1. A will experience the emotion fear in the presence of B in accordance with n.

2. A will avoid B in accordance with n.

3. A will be relieved when B leaves his presence in accordance to n.

4. A thinks that B may will harm A in accordance with n.

2.1.4 ATTRACTION-REPULSION -

This dimension denotes the physical attraction or repulsion one person may have toward another. For example

(18) John is attracted to Mary.

JOHN <a> ATTRACTION(+3) <--o-- MARY

(19) John finds Mary repulsive.

JOHN <a> ATTRACTION(-8) <--o-- MARY

(20) John was grossed out by his blind date.

JOHN <a> ATTRACTION(-10) <--o-- DATE

(21) John thinks Mary is a real turn on.

JOHN <a> ATTRACTION(+8) <--o-- MARY

2.1.4.1 Rules -

Some rules of inference regarding A having ATTRACTION degree n toward B are:

1. A might want to be with B in accordance with n.
2. A might want to have sex with B in accordance with n.
3. A will enjoy looking at B in accordance with n.
4. A evaluates B's physical appearance to be in accordance with n.

2.1.5 JEALOUSY-CONCERN -

This dimension predicts the emotional reactions an individual may have toward another's success or failure. For example:

(22) John is jealous of Mary.

JOHN <a> JEALOUSY(+5) <--o-- MARY

(23) John is extremely envious of Bill.

JOHN <a> JEALOUSY(+8) <--o-- BILL

(24) The professor showed great concern for his students.

PROFESSOR <a> JEALOUSY(-8) <--o-- STUDENTS

2.1.5.1 Rules -

If A has JEALOUSY degree n toward B then

1. If B succeeds in something or obtains something of value, then A will feel a positive or negative emotion depending on n.

2. If B wants something, then A will help or hinder B depending on n.

2.1.6 IRRITATION-COMFORT -

The tendency of a person to habitually cause another to become angry or tranquil is expressed on this attitudinal dimension. For example

(25) John finds Bill irritating.

JOHN <a> IRRITATION(+5) <--o-- BILL

(26) John finds Bill exasperating.

JOHN <a> IRRITATION(+10) <--o-- BILL

(27) John finds undergraduates annoying.

JOHN <a> IRRITATION(+5) <--o-- UNDERGRADUATES

(28) Linguists irk me.

I <a> IRRITATION(+8) <--o-- LINGUISTS

(29) John finds Bill relaxing to be with.

JOHN <a> IRRITATION(-5) <--o-- BILL

2.1.6.1 Rules -

If A has IRRITATION-COMFORT degree n by B, then

1. If A is with B, A may become more or less angry depending on n.

2. A will seek out B's company depending on n.

3. A may develop FONDNESS-ANTIPATHY toward B depending on n.

4. If n is high positive, A may be rude to B.

2.2 Evaluative Attitudes

Some attitudes contain an evaluative component as well as an emotive one. For example, "John respects Mary" is an instance of an evaluative attitude. This state is different from the emotive attitudes just discussed since it entails John making some cognitive judgment about Mary. Also, unlike an emotive attitude, "John respects Mary" does not predict any emotional reaction by John toward Mary.

On the other hand, an evaluative attitude is different than a belief, or or purely cognitive evaluation of a person. The difference between a belief and an evaluative attitude can be seen from the point of view of the beholder: A person who has a belief about someone else thinks that his belief is a true fact about that person, while a person who has an evaluative attitude feels it is a fact about himself. For example, if John believes that Mary is smart, then he thinks that her being smart is a true fact about Mary. On the other hand, if John respects Mary, then he knows that this is not a fact about Mary, but a characterization of his own view of her.

Evaluative attitudes are closely related to, but distinct from, evaluations of a person's character. For example, "John thinks that Mary is a respectable person" is a character evaluation rather than an evaluative attitude because from John's point of view this is a true fact about Mary. The difference between evaluative attitudes and character evaluations manifests itself as follows: An inference from a character evaluation is that other people should also have that evaluation, whereas this inference is not necessarily true for evaluative attitudes. Thus if John thinks Mary is worthy of respect, then he probably feels other people should think she is also. But if John respects Mary, he need not feel that others respect her.

Evaluative attitudes and character evaluations seem closely related because a powerful inference rule often connects them. For example, if John feels that Mary is respect-worthy, then he probably respects her. The notion of character evaluations raises two representational issues: how to represent cognitive evaluations, and how to represent personality characteriztions. Neither of these issues is understood well enough at the present to be included in this paper.

We have discerned the following evaluative attitudes:

2.2.1 RESPECT-DISDAIN -

RESPECT-DISDAIN is the basic evaluative attitude. It denotes a positive or negative judgment of someone according to some value system. Some examples of sentences encoding evaluative attitudes are:

(30) John respects Mary.

JOHN <a> RESPECT(+3) <--o-- MARY

(31) John admires Bill

JOHN <a> RESPECT(+5) <--o-- BILL

(32) John thought the tramp was contemptible.

JOHN <a> RESPECT(-3) <--o-- MARY

(33) John holds Mary in high esteem.

JOHN <a> RESPECT(+8) <--o-- MARY

(34) Mary reveres her minister.

MARY <a> RESPECT(+10) <--o-- MINISTER

2.2.1.1 Rules -

If A has a RESPECT attitude of degree n toward B, then the following rules are applicable:

1. A will consider B's wants and goals against his own in accordance with n. For example, A may give B his seat if n is high positive, but would take the only seat available if n is low negative.

2. A will be polite or rude to B in accordance with n.

3. A will wish to establish positive social relationships with B in accordance with n. For example, if n is high, A might wish to become B's friend, business associate, disciple, or teacher. If such a relationship exists, and A develops a low negative RESPECT toward B, then A might move to severe the relationship.

4. A will want to be associated with B by his community in accordance with n.

2.2.2 TRUST-DISTRUST -

TRUST-DISTRUST is an attitudinal dimension specific to evaluating a persons honesty with respect to the person holding the attitude. For example, we have

(35) John trusts Bill.

JOHN <a> TRUST(+5) <--o-- BILL

(36) John believes Bill will be honest with him.

JOHN <a> TRUST(+5) <--o-- BILL

(37) John trusts the English.

JOHN <a> TRUST(+5) <--o-- ENGLISH

(38) The Chinese distrust the Japanese.

CHINESE <a> TRUST(-5) <--o-- JAPANESE

(39) John has boundless faith in Bill.

JOHN <a> TRUST(+10) <--o-- BILL

2.2.3 Rules -

Given that A has TRUST of degree n toward B, then the following rules hold:

1. A will ask B to do tasks whose importance to A are proportional to n.

2. If B tells A something, A will give it credibility in accordance with n.

3. If n is negative, and B offers A a deal, then A will be suspicious of B in accordance with n.

4. If n is negative, A will not want to leave B alone with his possessions in accordance with n.

2.3 Obligational Attitudes

There are two kinds of obligational attitudes: an attitude related to a social debt between to people, and an attitude related to one's social responsibities.

2.3.1 INDEBTEDNESS -

INDEBTEDNESS expresses the feeling of having a non-material debt to someone. For example:

(40) Mary is indebted to John.

MARY <a> INDEBTEDNESS(+3) <--o-- JOHN

(41) Mary feels grateful to John.

MARY <a> INDEBTEDNESS(+3) <--o-- JOHN

(42) Mary owes John her life.

MARY <a> INDEBTEDNESS(+10) <--o-- JOHN

(43) Mary feels she owes John her life.

MARY <a> INDEBTEDNESS(+10) <--o-- JOHN

(44) Mary owes John a favor.

MARY <a> INDEBTEDNESS(+1) <--o-- JOHN

(45) John feels that Mary owes him her life.

JOHN <a> INDEBTEDNESS(-10) <--o-- MARY

(46) John feels that Mary is in his debt.

JOHN <a> INDEBTEDNESS(-3) <--o-- Mary

2.3.1.1 Rules -

If A thinks that C has INDEBTEDNESS degree n toward B, then we have the following:

1. A thinks that if B asks a favor of C, then C will comply with B if the cost of the favor to B is not of a greater order of magnitude than n.

2. A thinks that C should comply to a request from B if the cost of the favor to B is not of a greater order of magnitude than n.

3. A thinks that C might offer to do a favor for B in accordance with n.

4. A thinks C might offer to reward B fiscally in accordance with n.

5. A thinks that if C does not recognize that C has INDEBTEDNESS n toward B, then B may become angry at C.

6. In all the above rules, if A=C, and the rule predicts that A thinks C will do something, then A will do that thing.

2.3.2 RESPONSIBILITY -

A person may take on himself the job of guarding another persons well-being and subsume that person's social debts. Responsibility is a +10 to 0 scale, since there is no clear interpretation to be given to a negative responsibility. For example, consider:

(47) John felt he should look after Mary.

JOHN <a> RESPONSIBILITY(+5) <--o-- MARY

(48) John felt totally responsible for Mary.

JOHN <a> RESPONSIBILITY(+10) <--o-- MARY

(49) John didn't feel that Mary was his responsibility.

JOHN <a> RESPONSIBILITY(0) <--o-- MARY

2.3.2.1 Rules -

If A is RESPONSIBILITY degree n for B then

1. If B is endangered, A will try to save B in accordance with n.

2. If B accumulates a debt, A will pay off the debt in accordance with n.

3. A will give B things that B wants in accordance with n.

4. A will try to teach B to take care of B.

5. A will try to give B the things that A feels B should have.

2.4 Combined Attitudes

Many language utterances need to be represented as points along several scales, and therefore have been neglected thus far. The following is a sample of some frequently occurring combinations of attitudes:

(50) John is in awe of Bill.

JOHN <a> RESPECT(+10) <--o-- BILL

and

JOHN <a> FEAR(+3) <--o-- BILL

(51) John idolizes Bill.

JOHN <a> RESPECT(+10) <--o-- BILL

and

(JOHN BE LIKE BILL) --> GOAL(BILL)

(52) John felt responsible to Mary's father for taking care of her.

```
JOHN <a> INDEBTEDNESS(+n) <--o-- MARY'S FATHER
     /\
     || LEADTO
     ||
JOHN <a> RESPONSIBITY(+n) <--o-- MARY
```

(53) John prefers Mary to Jane.

(54) John likes Mary better than Jane.

JOHN <a> FONDNESS(n) <--o-- MARY

and

JOHN <a> FONDNESS(m) <--o-- JANE

and

n > m

3.0 ATTITUDES TOWARD OBJECTS.

Many of the emotive attitudes in the previous section are also applicable toward physical objects as well as people. We distinguish here between attitudes directed toward an object itself as opposed to what one may do with that object. Attitudes expressed toward an object may actually refer to the sensual experience of the object, or to an activity using that object. These types of attitudes

are discussed in later sections of this paper.

We use the following attitudes toward objects:

FONDNESS-ANTIPATHY

FASCINATION-DISINTEREST

FEAR-CONFIDENCE

3.1 FONDNESS-ANTIPATHY

For example, we have sentences like

(55) John likes cars.

JOHN <a> FONDNESS(+3) <--o-- CARS

(56) John loves his Luger.

JOHN <a> FONDNESS(+8) <--o-- LUGER
^
|
POSS(JOHN)

(57) John hates loose leaf paper.

JOHN <a> FONDNESS(-8) <--o-- LOOSE LEAF PAPER

The following rules apply to A being in a FONDNESS-ANTIPATHY relationship of degree n with object O:

1. If n is positive and A doesn't have O, A might want to own O.

2. If n is negative, A might will try to avoid O.

3. If A has O, A will take care of O in accordance with n.

4. If n is high positive (low negative), A will like to praise (bad-mouth) O.

3.2 FASCINATION-DISINTEREST

(58) John has a fascination with diamonds.

JOHN <a> FASCINATION(+8) <--o-- DIAMONDS

(59) John is bored by knick-knacks.

JOHN <a> FASCINATION(-5) <--o-- KNICK-KNACKS

IF A is in a FONDNESS-ANTIPATHY relationship of degree n with object O, then we have

1. If n is positive and A doesn't have O, A might want to own O.

2. If n is negative, A might will try to avoid O.

3. If A has O, A will take care of O in accordance with n.

4. If n is high positive (low negative), A will like to praise (bad-mouth) O.

5. If A is doing something with O, then A will feel the emotion of being fascinated or bored in accordance with n.

3.3 FEAR-CONFIDENCE

(60) John is afraid of dolls.

JOHN <a> FEAR(+5) <--o-- DOLLS

(61) Horseshoes made John feel confident.

JOHN <a> FEAR(-5) <--o-- HORSESHOES

(62) John has pyrophobia.

JOHN <a> FEAR(+10) <--o-- FIRE

The following rules apply to A being in a FEAR-CONFIDENCE relationship of degree n with object O:

1. If n is positive and A doesn't have O, A might want to own O.

2. If n is negative, A might will try to avoid O.

3. A's fear level will go up or down upon exposure to O in accordance with n.

4.0 ATTITUDES TOWARD ACTIVITIES

Some of the attitudes the people have toward people may also be directed toward activities -- toward pastimes, toward jobs, and toward things that have to get done. In particular, we have found the following attitudinal primitives useful in representing attitudes toward activities:

FONDNESS-ANTIPATHY

FASCINATION-DISINTEREST

FEAR-SECURITY

Note that these are a subset of the emotive attitude primitives we used to describe attitudes toward people - it makes little sense to talk of obligations to or trust of an activity.

This section is concerned with attitudes toward activities themselves (e. g., enjoying skiing), as opposed to attitudes toward sensations that may be derived from an activity (e. g., enjoying the feel of the snow), or attitudes toward results of activities (e. g., enjoying winning the slolum). Attitudes toward sensations and attitudes toward results of activities are discussed in later sections of this paper.

4.1 PLEASURE-ANNOYANCE

The PLEASURE-ANNOYANCE dimension is used to talk about basic positive and negative attitudes people have toward activities. This dimension is similar to the FONDNESS-ANTIPATHY dimension used to represent attitudes about people. An activity can be pleasurable, placing it high on this scale, or it can be annoying or frustrating, placing it low on this scale. The following examples involve the PLEASURE-ANNOYANCE dimension:

(63) Bill likes to play football.

```
BILL <a> PLEASURE(+3) <--o-- (BILL <=> FOOTBALL-SCRIPT)
```

(64) John loves to repair cars.

```
                          JOHN <=> DO
                                /\
JOHN <a> PLEASURE(+8) <--o--    || LEADTO
                                ||
                          CAR BE WORKING
```

(65) Joe thinks fixing cars is a pain.

```
                          JOE <=> DO
                               /\
JOE <a> PLEASURE(-5) <--o--    || LEADTO
                               ||
                         CAR BE WORKING
```

(66) Jane enjoys listening to music.

```
JANE <a> PLEASURE (+3) <--o--
                                    |--> music
        JANE <=> ATTEND <-o- ear <-|
                                    |--<
```

(67) Joyce hates going to Italian restaurants.

```
JOYCE <a> PLEASURE (-8) <--o-- JOYCE <=> RESTAURANT-SCRIPT
                                                ^
                                                |
                                             ITALIAN
```

(68) John likes studying physics.

JOHN <a> PLEASURE (+3) <--o--
JOHN <=> STUDY-SCRIPT <--o-- PHYSICS

4.1.1 INFERENCE RULES -

The PLEASURE-ANNOYANCE scale has the following inference rules associated with it.

1. If person A has PLEASURE-ANNOYANCE of degree n toward activity B, then A will have the goal of doing activity B (of avoiding activity B if n is negative), with strength of the goal being a function of n.
2. The greater n is, the more person A will have the goal of doing activity B, and will seek opportunities to do activity B.
3. When person A is doing activity B, A will feel JOY in accordance with n. If n is high, then A will experience a great deal of JOY in doing B. If n is low negative, then A will be unhappy doing B.
4. If an opportunity presents itself to person A to do activity B instead of some other activity, then A will choose activity B in accordance with n.

4.2 FASCINATION-DISINTEREST

The FASCINATION-DISINTEREST dimension is used to represent interest or fascination one has toward an

activity. For example,

(69) John is fascinated with mathematics.

JOHN <a> FASCINATION(+8) <--o--
JOHN <=> STUDY-SCRIPT <--o-- MATHEMATICS

(70) Jane thinks learning physics is boring.

JANE <a> FASCINATION (-5) <--o--
JANE <=> STUDY-SCRIPT <--o-- PHYSICS

(71) Joan is fascinated with flying.

JOAN <a> FASCINATION (+8) <--o-- JOAN <=> FLYING-SCRIPT

(72) Bill is interested in skiing.

BILL <a> FASCINATION (+3) <--o-- BILL <=> SKIING-SCRIPT

(73) George isn't interested in mathematics.

GEORGE <a> FASCINATION (-2) <--o--
GEORGE <=> STUDY-SCRIPT <--o-- MATHEMATICS

4.2.1 INFERENCE RULES -

The following are the inferences that can be made if person A has FASCINATION of degree n toward activity B.

1. Person A will enjoy doing activity B in accordance with n.
2. Person A will seek (avoid) opportunities to do activity B in accordance with n.
3. When person A is doing activity B, A will experience JOY in accordance with n.
4. Person A will enjoy hearing about other persons' experiences doing activity B in accordance with n.
5. Person A will seek out information concerning

activity B in accordance with n.

4.3 FEAR-SECURITY

The FEAR-SECURITY dimension is used to represent the attitude of fear one might have toward an activity. Some examples of use of the FEAR-SECURITY dimension follow:

(74) Jane is afraid of flying.

JANE <a> FEAR(3) <--o-- JANE <=> FLYING-SCRIPT

(75) Driving is very relaxing for John.

JOHN <a> FEAR(-8) <--o-- JOHN <=> DRIVING-SCRIPT

(76)John is terrified of flying.

JOHN <a> FEAR(10) <--o-- JOHN <=> FLYING-SCRIPT

4.3.1 INFERENCE RULES -

The following are inferences that can be derived if person A has FEAR of degree n toward activity B.

1. Person A will experience the emotion fear when involved in activity B in accordance with n.
2. Person A thinks activity B will cause harm to A (or other persons involved in doing B) in accordance with n.
3. Person A will experience the emotion fear when somebody for whom person A has high FONDNESS is involved in activity B.

4. Person A will avoid activity B in accordance with n.
5. Person A will be relieved when an occurrence of activity B is completed.
6. Person A will experience unhappiness when doing activity B in accordance with n.

5.0 ATTITUDES TOWARD SENSATIONS

There are many attitudes toward experiences or objects which can best be described in terms of the derived sensual pleasure. Consider the following two sentences:

(77) Mary hates garlic.
(78) John likes to shoot up smack.

Example (77) seems to express a negative attitude about a kind of object, namely garlic. Such an interpretation in not entirely correct, as (77) does not mean that Mary actively detests cloves of garlic. A more precise interpretation of example (77) is that Mary dislikes the taste of garlic; that is, Mary's attitude is displeasure (and possibly repulsion) toward the sensation she experiences when tasting garlic.

Example (78) appears to be positive attitude towards an action, namely injecting smack into his veins. This appearence is deceiving. What John likes is the resulting sensual pleasure of being intoxicated by heroin. John

probably does NOT like the action of inserting a needle into his arm. Hence, the <u>like</u> in example (78) cannot refer to John's action; it refers to the sensation he eventually derives from his action.

We represent attitudes toward sensations in the following manner:

```
                                              X
                                              /\
X  <a>  SENSUAL-ATTITUDE( N ) <-o-            ||
                                              \/
                                          ATTEND <-o- sense-organ
                                                 <-d- object (or experience)
```

Only emotive attitudes are relevant in describing sensations, as it hard to interpret obligations or trust-distrust relationships to a sensation. The four scales used to represent sensual attirudes are:

PLEASURE - DISPLEASURE
FASCINATION - DISINTEREST
FEAR - SECURITY
ATTRACTION - REPULSION

Consider these examples of this representational scheme:

(79) Mary hates garlic.

```
MARY <s> PLEASURE-ANNOYANCE(-5)
         ATTRACTION-REPULSION(-5)
         <-o- (MARY <=> ATTEND <-o- TASTE-BUDS <-d- GARLIC)
```

(80) John likes to shoot up smack

```
JOHN <s> ATTRACTION-REPULSION(+10)
         PLEASURE-ANNOYANCE(+4)
         FEAR-SECURITY(-4)
         <-o- (JOHN <=> ATTEND <-o- all senses <-d- HEROIN)
```

(81) Mary likes Picasso paintings.

```
MARY <a> FASCINATION-DISINTEREST(+5)
         PLEASURE-ANNOYANCE(+3)
         <-o- (MARY <=> ATTEND <-o- EYES <-d- PAINTING
                                              ^
                                              |
                                        CREATOR(PICASSO)
```

(82) Mary is terrified by loud noises.

```
MARY <a> FEAR-SECURITY(+9)
         <-o- (MARY <=> ATTEND <-o- EARS <-d- SOUNDS
                                              |
                                        VOLUME(HIGH)
```

(83) John is a sex-maniac

```
JOHN <a> ATTRACTION-REPULSION(+9)
         FASCINATION-DISINTEREST(+7)
         PLEASURE-ANNOYANCE(>3)
         <-o- (JOHN <=> ATTEND <-o- all relevant senses
                               <-d- SEX-OBJECT
```

The main idea that the above representational scheme conveys is that a person derives a positive or negative sensual experience measured on the four emotive scales from a given object or experience through one (or more) of his/her sense organs.

There are several inferences that are facilitated by this representation. These inferences usually check features of the slots of the full conceptualization. Consider the inferences which can be made from these examples:

(84) Mary likes Picasso.

Inferences:

Mary may like to own Picasso paintings.

Mary may want to go view some Picasso paintings.

Mary may wish she could paint like Picasso.

(85) John really enjoys listening to Mary sing.

Inferences:

John will probably want to listen to Mary sing another time.

John may like Mary's voice.

John may want to own a recording of Mary singing.

John may want to be near Mary.

(86) Mary hates garlic.

Inferences:

Mary will refuse to eat garlic.

Mary will probably not cook with garlic.

Mary will probably not buy garlic.

These examples are instances of the more general inference rules listed below. In these rules, a person X has the attitude of PLEASURE-ANNOYNACE, FASCINATION-DISINTEREST or ATTRACTION-REPULSION toward attending sense organ S toward object Z.

1. If N is positive then expect X to have the goal of experiencing the sensation at some future time.

2. If N is negative then expect X to have the goal of avoiding experiencing the sensation.

3. If N is positive and Z is a physical object then X may have the goal of owning Z.

4. If N is positive and Z is an action with a physical object then X may have the goal of owning Z.

5. If N is negative and Z is a physical object expect X to give away Z.

6. If N is positive expect X to have the goal of being near Z.

7. If N is negative expect X to have the goal of getting away from Z.

8. If N is positive and Z is an action by Y, then X may have the goal of being near Y.

In addition, the following rules are specific to the particular attitude:

PLEASURE-ANNOYANCE

1. X will feel the emotion JOY in accordance with n while experiencing the sensation.

FASCINATION-DISINTEREST

1. X will seek out information concerning the sensation in accordance with N.

2. X will enjoy hearing about other people's experience of the sensation in accordance wtih N.

ATTRACTION-REPULSION

1. X will evaluate the physical characteristics of Z to be in accordance with N.

FEAR-SECURITY

1. X will experience the emotion fear upon encountering the sensation in accordance with N.

2. X may think that experiencing the sensation will cause him harm in accordance with N.

3. X will seek to avoid the sensation in accordance with N.

6.0 ATTITUDES TOWARDS STATES

So far we have encountered attitudes towards people, activities, objects, and sensations. In addition, there are a number of attitudes that may be directed toward states. For example, consider:

(87) Mary likes her hair short.
(88) John likes having a clean house.
(89) Bill likes winning.

In each of these cases we have an attitude towards a state distinct from the attitude towards the activity resulting in that state. Mary likes her hair short, but she may hate getting it cut; a clean house pleases John, but he may not like housecleaning; and Bill likes winning, but he may not enjoy the competition.

The attitude primitives we propose for representing attitudes toward states are:

Emotive Attitudes

PLEASURE-ANNOYANCE

FEAR-SECURITY

IRRITATION-COMFORT

Obligational Attitudes

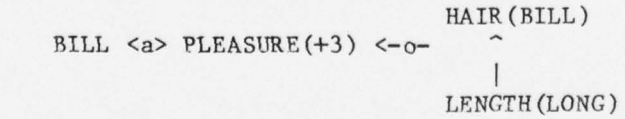
RESPONSIBILITY

6.1 Emotive Attitudes

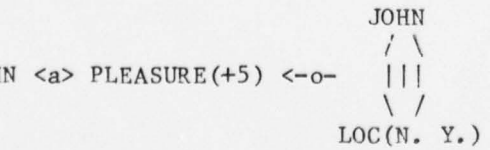
6.1.1 PLEASURE-ANNOYANCE -

This is once again the basic positive-negative attitudinal dimension. The following are examples of PLEASURE-ANNOYANCE held toward states:

(90) Bill likes wearing his hair long.



(91) John really likes being in New York.



(92) Mary hates it when her car doesn't work.

MARY <a> PLEASURE(-8) <-o- CAR <--- BROKEN

6.1.1.1 Rules -

The following rules apply when A has PLEASURE-ANNOYANCE of degree n with state S:

1. If n is positive, and A is not in state S, then A will want to be in S.

2. If n is positive, and action Q will cause A to be in state S, then A will probably do Q.

3. If n is negative, and A is in state S, A will try to get out of S.

4. If n is negative, A will try to avoid actions that will cause state S.

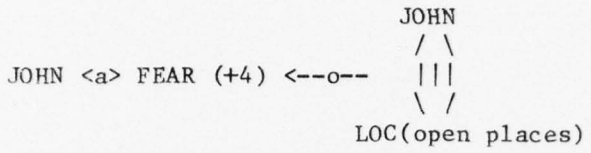
6.1.2 FEAR-SECURITY -

It is also possible to feel fear towards being in a state, or get security from being in one.

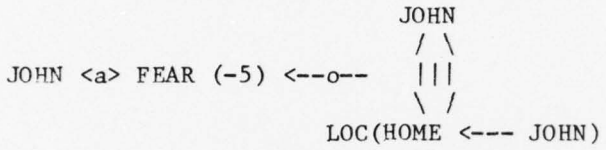
(93) John is scared of being injured.

JOHN <a> FEAR (+4) <--o-- JOHN <--- PSTATE(-x)

(94) John is afraid of open places.



(95) John feels secure when he's at home.



6.1.2.1 Rules -

If actor A is in a FEAR-SECURITY relation of degree n with state S, then we have the following:

1. A will experience fear when in S, proportional to degree of n.

2. A will avoid being in state S if n is positive.

3. A will try to be in state S if n is negative (i.e. high security).

4. If n is positive, and Q is an act that may cause state S, then A will try to prevent Q from occurring.

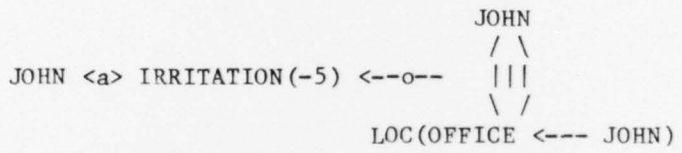
5. A will be relieved at the cessation of S in accordance with n.

6. A thinks S will be harmful to A in accordance with n.

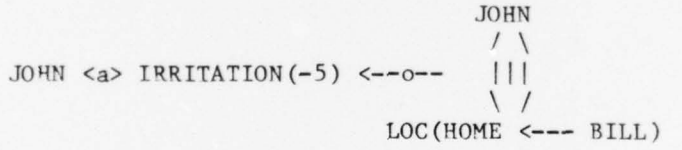
6.1.3 IRRITATION-COMFORT -

For example:

(96) John finds being in his office irritating.



(97) John is very relaxed at Bill's home.



6.1.3.1 Rules -

If A is in an Irritation-comfort relation with S of degree n, then the following rules hold:

1. If A is in state B, A will be more or less irritable according to n.

2. A will seek out, or avoid state S depending on n.

3. A may develop a Pleasure-annoyance relation with S depending on n.

6.2 Obligational Attitudes

A person may have an attitude of RESPONSIBILITY for a state. For example, consider

(98) The guard felt responsible for protecting Mary's jewelry.

```
                                                    JEWELRY
GUARD <a> RESPONSIBILITY(5) <--o-- PRESERVE           ↑
                                                  POSS(MARY)
```

(99) The maid felt that keeping the house clean was her responsibilty.

```
                                                    HOUSE
MAID <a> RESPONSIBILITY(5) <--o-- PRESERVE            ↑
                                                    CLEAN
```

(100) John didn't feel obligated to maintain Mary's car.

```
                                                  CAR <--- POSS(Mary)
JOHN <a> RESPONSIBILITY(0) <--o-- PRESERVE          ↑
                                                  WORKING
```

6.2.1 Rules -

If actor A feels RESPONSIBILITY toward state S with degree n, then

1. If S is endangered by event E, A will try to prevent E depending on n.

2. A will feel guilty if S is undone or prevented, in accordance with n.

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